Notebook Series -- Notebooks by Edison
Notebook, N-19-06-18

This notebook was used by Edison during June-August 1919. The entries in the first half of the book are a continuation of the electroplating, electrolytic cleaning, and dip cleaning experiments in N-19-05-28. These experiments formed part of Edison's efforts to improve the commercial manufacturing processes involved in making disc records, which included attempts to reuse master matrices for making more generations of molds from one recording. The entries in the middle of the book pertain to a variety of subjects, including the recovery of nickel flake after cleaning storage batteries, experiments to reclaim nickel sulphate out of "nickel iron mud" from waste water at factories, and additional experiments relative to disc record manufacture. One entry describes tests of a "whirler" for removing water from disc records to dry them for varnishing. There is also an entry with a series of "questions to ask a chemist." The last part of the book describes experiments that began a "campaign to produce a starting storage battery for Ford cars to beat the lead" batteries made by other manufacturers. These experiments indicate the convergence of Edison's work on battery and disc record manufacture in terms of electroplating. The experiments on a starter battery and electroplating are continued in N-19-08-26. The notes indicate that Adolph F. Gall, John McMullen, Walter H. Miller, Frederick P. Ott, and Ludwig F. (Louis) Ott assisted Edison. The front cover is labeled "No 2 General Experiments June 17 1919." The pages are unnumbered. Approximately 120 pages have been used.

3.785 cc m 9

gallon

81082
Ames Co.,
MFG. STATIONERS,
95 JOHN ST.

June 18 1919

10 am

Plating nickel even thin on a Copper Cathode filmed with Selenium & then electroplating & putting another thin film of Ni over 1st Ni & subsequently plating with thick Copper is OK - also when washed & dried between the 2 nickel coats,

Also when allowed to remain in bath without Current for ½ hour & then resume plating —

In fact none of the likely neglects will interfere with the ultimate result

Note that in stripping Copper from a Copper filmed with Se

none of the Copper Selenium film is transferred to the plated film to amount to anything for 6 or 8 stripping. But when metal is stripped it takes some of the Se film as is seen by lightening the color of film left on the Copper hence probably only 3 stripping can be taken before

a slight redip in selenious acid is necessary

Note To test porosity of Matrix of Copper - dip in 75% HNO_3 3 seconds but first clean surface by Current in Na_2SO_4 (alkaline) —

June 18 1919 #1 new press

First matrix, (Lucite) cleaned in new bath 3 on bench —
Graphite Electrode only
17 amperes — 16 volts in series
Washed by power spray
strong a low angle then
rinsed with distilled
water — Then put in
8 qual 450 cc of 5% Schumacher
acid bath in hard rubber
filtered, 2½ minutes
Red Castile, washed
with spray then
distilled water —

dried, then one coat Condemit
Varnish on back to 1/4"
of Edge — next morning
a second Coat put on
& given to gall to make
full thick matrix
formate —

The cleaning bath is
Conc Na_2SO_4 — just
colors red litmus blue
filtered thru sand
17 amp is not enough

June 19 1919

This morning put graphite anode with 2½ @ 3" of revolving disc at angle Tack cut felter cloth partition –

Put wash jets above –

also multiple wired cells so there is 8 cells on this gives 45 to 50 amp on ½ disc which is ample for cleaning –

We are getting ready for #2 disc +

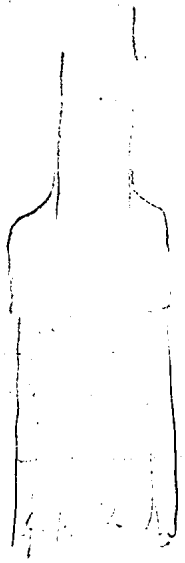
No 2

Cleaning 40 amp for 5 min – washed

#2 stained 3 Lithospalo not reddened - probably excess Wash could need a trouble brush for removing excess which have dried on matrix as water gels do not remove them -

with strong spray. Then distilled water -
Transferred to Selenium bath, 4 minutes -
Very deep red verging on blue, Washed with spray, then distilled water. Then allowed to dry - after dry painted with Condensite Varnish - (No lamp black) thinned down by alcohol
As #2 dries it turns more blue - think

6/19/19



Took black bristle brush cut 1/2 inch off – This makes it differ 4 well

use this one No 3 before

Electric Cleaning & in water get to detach any dried on dirt that will not come off with water jet or Hydrogen

3 minutes we see will answer

1/2 hour after taking from bath & dry it is all blue conferming that 3 minutes immersion in Deionized acid bath is sufficient

Started breathing back with 1st Coat Vacuum 11 am finished 11 15. will let it dry till 1 pm —

at 1 put on 2nd Coat,

#3 Disc

Cleaned 5 minutes in Na_2SO_4 (alkaline).
Then washed and brushed under spray of water to detach and particles which stick — Then washed distilled water,

I noticed this time that the disc got darker on immersion especially the back —

Sulphur is certainly coming out of rubber bath, as a small cleaned strip of green experimental catch held in bath for 1 3/4 hour turned red & one place blue —

We have got to get rid of Rubber —

#3 was in cleaning solution & was not brightened at any back was to grac wash in 5 minutes, 40 amperes

Washed & used the bristle brush while being washed,

The immersed in Selenium bath 3 minutes, its red before drying-

Only one uncovered spot shows about .010 dia-

Brush may not be stiff enough - probably wants Scrubbing brush bristles-

With 3 min immersion in Se it does not turn blue on drying but the red shade deepens after 1/2 hours dry its nearly blue so 2 3/4 to 3 min is OK

3 pm fred started rubbing on 1st Coat Varnish on back

June 19 1919

#3 went over to Hall at 5 30 pm

We now have a white enamelled bath which we will replace the rubber – Cost 3 98/100 at Hayne Newark – getting overflow part in + suspension for chuck of graphite –

I left a ¼ of a dollar
Silver piece in Solution of Caustic
Reg Solution I been using
48 hours, it is not attacked

June 21 1919

Just made a test with Na_2SO_4
10 with, to see about alkalinity
Solution is neutral –

If 1 cc of 20% NaOH is
is used to 100 cc of Na_2SO_4
nearly saturated it turns
Red Litmus strongly blue –

Hence I think One per cent
of 20% NaOH to 100 per ct of
Na_2SO_4 is OK for Electric
Cleaning –

This will take off grease
at its maximum solubility

1st Female came off OK - paint
not very good lots coats
but these easily colorized so
the build up them on one hour +
Selenium on — put on 2
more coats on top of 1st
Varnish 1 1/4 hour drying
between each coat before
going to Potts —
Some roughness pulled off in 1/4 @ 1/2 hr
Some varnish in getting it into off —

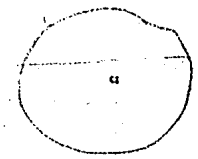
The Na_2SO_4 alone in the regular
with iron post + anod, left 36
hours, the solution full Fe_2O_3 ppt
I then put 1% NaOH in +
started following it came
clear in 2 hours —

Note this Matrix
(washed after cleaning
after 4/8)

4

I notice that this disc blackened ½ when in the Solution.

There was an open cement + while rotating the Cement went on we found ½ black



Kept it on for 5 min. then washed used bristle brush while washing then put in 4/8 for 3½ min washed + Brushed while washing — dried ½ deep blue ½ red there are several opals not 4/8 apparently also lot of finger marks on Edge —

Hereafter Gall will clean with alcohol & Vienna lime to remove finger marks

The cleaning solution is
25 Litres Na_2SO_4 - 4 lbs
or had 350 cc of 20%
Electrolyte added in it but
I find this is not alkaline
enough it does clean in
this - alkali probably not
strong enough to remove
grease I have now
added 100 cc more of
NaOH. - Making 25 Litres
Na_2SO_4 solution and 0 and
or 450 cc 20% NaOH.
But after running a while
Lilian shows this is not
strong enough alkaline
added 100 cc more NaOH
Altogether 550 cc
or 2.2% NaOH 20%

#5

Is the old matrix we been using to adjust by. it got black than lighter than black — the tried clean with Ray + weak Nitric Conduct, finally sent over to have it cleaned by hand with Vienna lime

Cleaned in Sol 4 min trucked —
Then in 4/8 3 $\frac{1}{2}$ min deep seed — Didn't Enough
washed distilled water

washed + dried & note a
lot of 020 bright spots
like
they [illegible]
wash in 4/8 sol ant
Repeat sol away from Cu
in solution – Transferred
& sent to Gale –
Both baths worked OK
Cleaning bath fully
alkaline + clear
At 600 Rev dries in 1 3/4
minutes – this will
adapt –

June 25 1919

We just tested a whirler for whirling water off disc after final washing to dry disc for examining the crack –

After whirling it took $2\frac{1}{2}$ minutes for disc to be bone dry – The speed was rather slow –

We will speed it up a little –

June 26 1919

Got 3 female murders, holder wrong had fix them —
Noticed finger marks all around Edge — Electro Cleaning does not take them off — Cleaned 5 min brushed, washed & put in 8/4 3½ min —
finger marks on both No 1 & 2 dont come off —
Something well have to be done to stop

This — #3 female
has marks from fingers &
something else - or shows
bright 3/8 dia when head
is fixed — its at Edge of
music —
The Matrix is spaced
by a big 5" scratch
clear across music
Note = #1 was turned on
back but #2 & 3
female not turned
Feed is pulling on 3
Coats of undituled Varnish

June 27 1919

Last night I left a clean Copper strip (part of medium) in 20% NaOH Electrolyte used by S B Cobb & found after 15 hours it was dark brown almost black

Another strip in Conc Na_2SO_4 was still bright.

Showing that our blackening bracteas is from NaOH —

& OH deposited

black on platina dish from platina made in the 20% NaOH, a deep black, but it requires high current low density does not bring it out. He found it was iron

Last night we sent 3 female workers over for Nickel plating after 14 hours they were not bent & plating was going

on OK - but the only reason is that the plating is full of Fe_2O_3 specs which float in the bright & cover all parts not as well as metal - it is this spongy material going into the plated Ni that reduces the strain & prevents cracking

Because if we filter the solution the Ni is very bright even after 24 hours at 1 amp but the strain is so great it cracks -

I must find some way to reduce the strain & increase the current density

June 27 1919

Took 3 more made such matrix
Washed & brushed, Cleaned
Electrolytically in Na_2SO_4
Conc (alkaline)
5 minutes washed rinsed
distilled water

Put in 8/4 - but this has
weakened by the 5 discussed
& by the Nickel tap on
affairs Required 4½
to 5½ min for light red
washed, rinsed distilled water
dried in new Tin cabinet

Ready for Varnishing -

These 3 took better than
the 1 to 5 = have less
finger marks Ela

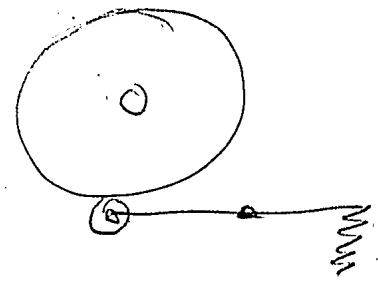
(51)

They are numbered
6 7 + 8 – Male –

~~Here~~

Have struck a snag –
it seems that the first
female from a Master
comes off OK but when
the Master is turned off
at Edge to separate the
2nd female, they turn off
the 8/4 film hence when
put in bath has to be
turned down more
hereafter we must

make Edges after separating
8/4 blue —



purpose run dense 1 Rev
in 2 to 4 minutes left.
which wet with weaning
strong 8/4 solution —
hence Edges a shade
thicker will get film

Above will work but get
better thing - by using
5% Se Solution without

28 June 1919

vertical detection it acts
instantly. We use 1/16" hair
Camel hair brush + minimum
of liquid no drop but what
is held by Capillarity between
the hairs by painting the
Edge + varnish side + a little
over 1/32 or less on mirror
side it leaves no sticking
We will do this each time
a stripping takes place
as we must turn film off
on Edge to get stripping

Later June 30 1919
Conc 5% Sol of Se
was too slow for painting
Edge as on preparation showed
some free Selen.
I am now using
75 parts water
25 " of 5% Sol of Selenous
acid. This gives a deep
fine red ——

Later, July 28 - above Sol
is OK

I painted a straight line on
a small Cutlike line not
.020 wide — also a edge
without clipping a bit
on either Edge more than
.005 - ~~at~~ it covered in
Copper bath perfectly
was quick as the unbroaded
parts —
This was adopt.
But I think, may have
to weaken the 5% Se
to 2½ or even 1½
as in time it will foul

the bath, however the Copper anode will stop it but depositing it out of the solution, in fact we could put some sheet Copper in Crocks –

Note, a Cone Sol of K_2Off. turns a cleaned Cathode (by Elec) very quickly a deep yellow,

9-10-11 Masters

(Dec 6)

all the same look fair
& even - some finger marks
on edges - 5 min cleaning
& 1 was 10 min in 8/4
being weak - strengthened
8/4 & colored other
2 deepened in 2½
minutes -
~~yes~~ varnished ok -
Polished -
These should be
greed

S Battery - Jan 30 1916

Recovered flake is brown a red color after cleaning at Langley Battery & finishing with acid —

I tried many things but of no avail for cleaning it bright finally lucky thought was to use Oxalic acid 1½% sol, warm —

The oxalic ~~[illegible]~~ acts on the nickel but oxalate thus being insoluble is deposited with flake underneath the dark covering to prevent expansion mechanically removes the dark film then by agitation the oxalate of Ni is readily removed by decantation & washing several times, finally Ammonia is put in water with flake — this combines

with the oxalic & become very soluble & the whole is washed free leaving the flake as bright & clean as new flake. This proves 40 C per cell & recovers us to use old flake —

The batch of old flake in beaker on pie plate on hot plate goes very much quicker than cold,

We should have to use heat probably 150° F to get quick action

The solution in each beaker is 750 cc 1.33% Oxalic —

This is more than enough after drying twice weigh the flake

June 30 1919

Note use of 75 pts H_2O
25 pts of 5% vol
determined for
Painting Edges of Mantles
& female Mantles

Think 1% or even 1/2 %
solution of Oxalic acid
not hot or concentrated,
flake very bright —

~~June~~ 31 1919
July 1 —

The flake from stronger
Oxalic was best, better
than 1500 cc 10 grms
Oxalic 24 hours —

I now adopt 20 grms
Oxalic 1500 cc water
100° Fahr 24 hours to 50 gallons
then agitate with paddle
& decant after settling —
2500 cc Extra water dilute
this until only little
milk — then add slowly
to the 50 grms flake 50

Add Ammonia – 8 hours
with some agitation.
Then decant off the
Oxalate of Nickel –
Then add Excess water
& wash free of
Ni Oxalate.
While Excess water
out in a Centrifuge
& dry —

July 3 1919 Glory! S S

Have got prints off 3 working moulds which were made by new 8/4 process—
1st a metallic submaster—
8/4 then female Matrix—
then 8/4 then Nickel 004
+ backed by Copper Turned
+ put in Reg working moulds & prints on Condensite made
The General surface Considerably better than by regular process
yet 1 Celluloid present intervened

Note, They have been in habit of grinding submasters We shall not need to do this when 8/4 process is used —

JP

When we work direct from the Master itself we are quite sure the general surface will be so reduced that only surface will be the original wax surface & the blank surface — the start is good —

JCG

July 3 1919

Walter Miller made 2 tracked blanks these were grafted + plated + mounted in clam for cleaning —

Put in cleaning Electrobath + cleaned 4 minutes 5a amp — think 2 or 3 mins enough — look fine no finger marks on edge

Washed them in 8/4 - to dark red, washed dried in colander + sent to Mac Thursday PM

July 6th

Standard painting solution with Brush is

75 parts Water
25 " of a 5% solution of S/4

Think these will come out perfect,

The latest is that the Center of Matrix stick - Gall thinks the Canal Rolled Copper he uses in Center not get S/4 Enough so hereafter we will paint Center. where Canal Copper is with brush 4 S/4 25% of 5% solution

I made about 5% sol of KCy & with the strips of matrix, cleaned it Electrolytically — Coated it with 8/4 7 times washed & Each time dipped in the KCy, which almost instantly removed the blue film of 8/4 — The 7 layers didn't appear to remove any of the record waves

they were smooth & all that I could see that was done was the polish was gone Dont think the 7 dips & removal took 1/100000 of inch off. -

This shows film from a Matrix was 68 removed by a 2 or 3 second dip in 5% KCy Solution - after

removal should be
wiped with cloth &
washed in cylinder

July 8th – The 2 females
from tracked matrix came
out apparently without
finger marks & OK
Cleaned & S/Kd & returned
them to Mac for coking
mould plating –
So far OK –

July 19 1919

Process for obtaining Nickel Sulphate out of Nickel iron mud from waste wash water at Sta Works, Thereon down by Carb Soda

1st Be certain there is an Excess of Carb Soda used to insure precipitation of all the Nickel as Carbonate

2d See that before press is unloaded that all the Sulphates + Carbonates of Soda is washed out of filter press Cake, not all but only slight amount left as it will contaminate the Ni Sulfate

3rd Put the Mud pest as it comes from the press into a Tank steam heated, Tank lead lined, also stirrer

4th Add enough water to make a thin pulp, stirring stirrer.

5th Gradually add 50/50 H_2SO_4 while stirring pulp water heated 180 to 212° until from previous qualitative test of Mud you have nearly enough added Run until test sample doesent lead turn black

6th When neutral add Cautiously a little more acid & again till neutral a time will come when

the last addition of acid will not run to neutral — The solution will be acid.

Its essential that towards the end the acid should be added in very small quantity

Avoid at the end too much free acid, as the amount of iron going into solution rapidly increases with the acidity.

Should a mistake be made & get too acid a little Carb Soda should be used to make it not redden blue litmus. Then there will be only a little iron in solution & the mix will not attack the filter pieces

The liquid which comes out of the filter press will be rather strong H_2SO_4 with some ferrous sulphate — When no more liquid will come out of cake at the pump pressure add a little wash water, then more wash water until the liquid is a light green —

After that put on more wash water but do not let it go into the first washings

Shunt it to another Tank

This weak solution can be put into the next tank lot,

The strong solution & the several small washings of press are put into a lead lined tank with lead lined stirrer & brought to boiling by steam jacket —

Add to solution a small quantity of Nitric acid to peroxidize the ferrous sulphate to ferric sulfate by test be sure that solution is fully peroxidized -

Now add a small quantity of Nickel hydroxide very finely divided - the dust $Ni(OH)_2$ from precipitation of Nickel hydrox at factory is ok Keep boiling -

The Ni hydrox will replace the ferric hydroxide & form sulphate of Ni. & the ferric hydroxide will be thrown out as a precipitate,

By testing from time to time by adding an excess of ammonia to a small sample of the Ni. solution

you can ascertain if all of the ferric hydrox is pre-
The solution can then be ~~[illegible]~~ run through a filter press,
If the washing of the original mud has been well done & all the free sulphuric or Carbonate of soda been washed out
& the peroxidizing of the iron sol properly done & the adding of nickel hydroxide properly done so all the iron is thrown out
The solution will be pure Concl Ni sulfate which may be concentrated to proper spec g or further Conc & crystallized

or made unto Mi Wthy selfalle.

July 19 1919

The working moulds of the 2 tracked blanks containing piano & intervals of silence caused them OK could not be better

Made prints, both had about same surface on any blank. only 1 cracks noticeable on each Public would never notice, One had several small cracks that could hear by using lens The other had hardly any The surface was good & that due to fibre in blank, The start was as good as the other parts, almost second & 2 over heard without lead cracks start,

When printed on a Dally blank surface is right near the limits of my hearing with the horn Dally's blank was hurried very screened thru 30 mesh 2 coats varnish -

I all got them as good

[1919]

as this, it leaves nothing more to be desired —

Carbonate of Copper precip from wash water from plating nickel flake —

This is worked the same as the Ni 72 method to get iron out,

The tanks should not be lead lined but Copper.

The stirrer tank should be Copper =

The solution of Cupric hydrate in Cyanide takes out all the iron even when the solution is a little acid. This acidity probably due to fact $CuSO_4$ itself is a Cyanide and — While I read

Note,
The Carb Cu from
S Britany is badly
Contaminated with
Iron, as bad as
Mt Fe Mud but it
dont show up
in mud like the Mt Fe
mud -

Possibly wood lack +
wooden stirrer might
be practicable —

Copper hydroxide to dissolve
the Fe, I think Carb Copper
must be dirty could be
used instead —
Because moves all precipitated
by Nitric added to filtered
solution but only just enough
~~[illegible]~~ Fe as any
Excess will have to be
neutralized by $Cu(OH)_2$

Wooden filter presses
will have to be lined
or Copper Linen cannot
be used as it is attacked by
Copper Oxy + it also puts
iron back in solution -

The solution of Fe free
$CuSO_4$ should be pumped
at Badenoch Count +
put in Crystallizing
Vats,

Note,

If I amalgamate the Nickel (Cond) with sodium amalgam in a large spot, then put in 1/2 strength hypochlorite + 200 Ma amp it copes practically all the surface amalgamated + very little of the other surface showing a cleaning action of the Hg.
HCl, H_2SO_4 Cathoding does not remove the negative protective Chemical of Nickel but apparently Amalgamating does —

Instead of Sodium amalgam think can use $HgCl_2$ in acid to amalgamate the Nickel Wash quick + transfer to Hypochlorite running bath say 25 Ma amp per inch

As to the adherence of Peroxide Ni_2 I rubbed fingers over surface + then washed, the 50%

Clung to anode when violently washed, the whole amalgamated spot was black —

It requires considerable time to form good adherent scale

Note Perhaps can use Nickel ~~p~~ coated black adherent $Ni(OH)_3$ or Sheet Zinc in 20% NaOH.
providing NaOH pure

After running over anode with amalgamated spot + cleaning + washing put it back at 200 Ma amperes after 1/2 hour removed + run finger over a several times, carefully found deposit had increased in thickness, put it back again — Spot is under probably creeping of Hg

VERY PROMISING

Questions for Chemist -

about how many [illegible] of water per lb of food [illegible] Evaporated in the [illegible] of Triple effect vacuum evaporator,

I precipitating [illegible] double decomposition [illegible] to it generally [illegible] to add an [illegible] precipitant for [illegible] trouble,

What is object of [illegible] a precipitate

What is [illegible] used for,

What is the special chemical substance used for detecting nickel -

Questions -

In filtering in Laboratory using Bunsen Vacuum filter with water ~~[illegible]~~ filter paper discs are used, suppose the substance somewhat attacks the paper + breaks it at the holes How do you obviate this -

How would you determine the Viscosity for instance of a liquid Varnish

Questions -

What is a reflex Condenser

Which gives the purest Crystals large crystals by slow Evaporation of very rapid Crystallization & small Crystals

How do you get small Crystals & how do you get large Crystals,

Questions.

What is principal impurities in Chamber acid (Sulphuric) made by the old process from Pyrites —

July 22 19

Wash water used per cycle in flake Dept.

Copper	3.46 gal
Ni	3.37 "
Total	6.83 "

19 Cranes in work 9 hour day
average number of strippings daily 2.75
Total strippings 46.75
Total plating cycles per day 5843 — (of 125 cycles per stripping)
Water used 42075 gals

Scheme –

Ni anode
Fe anode

Scotch –

Saturated 75% $NiSO_4$
" 25% $FeSO_4$

In plating use Ni anode
20 min Iron anode 5 min
so keep Fe constant in
solution – In the following
bags have iron wire chopped
up to keep solution in
ferrous state & good
circulation –

Note – July 22/19

McMullen up to now has taken 2 working mandels from the 2 cracked blanks (ie) 2 from each. I then recleaned them in 8/4 – to light red they were a little dead & made the shade deeper – Find not clean in NaOH. Eckline on red and varnish on –

Mac has other females from the master of black blanks now in plating –

Hereafter WCC refilm right along. after 2 working mandels taken off –

Note, it is surprising how little the black oxide of $Ni(OH)_3$ is attacked by H_2SO_4 — in the cold

Also oxalic acid Conc does not appear to attack it in the Cold —

~~Then~~

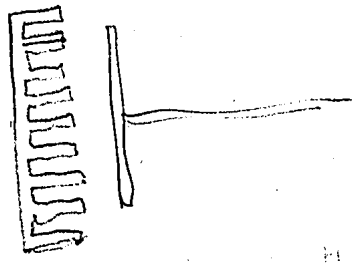
In plating with 75% $NiSO_4$ + 25% $FeSO_4$ | Nickel anode & iron tacks in solution, I find large amount of black deposit on top This is ferric hydroxide —

The Cause is that the hard rolled nickel is not properly attacked by the SO_3 ion hence this Oxidizes the iron to ferric

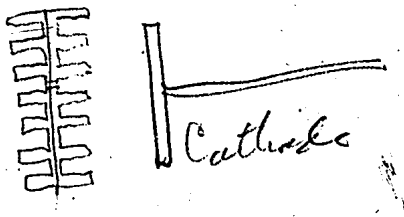
It is essential that either the anode should be rich in iron so Ni is easily attacked or Cast Ni anode used & a separate iron anode used to prevent Oxidizer —

Later = Think the best idea is to use say ~~[illegible]~~ anodes the surface of which gives 4 times less density of Current than the Cathode, the greater the size

of the anode as compared to the Cathode the less rock of the tendency of hardening from SO_3 given off & less from ferric oxide —

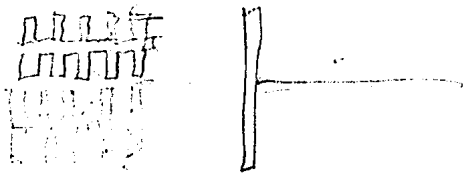


Holes Torn



Anode

or



Note =

Nickel will reduce copper to metal slowly from a $NiSO_4$ sol containing a little Copper Sulphate, ? ?

Note 48 hours on hot plate on asbestos disc - Nickel powder to reduce all the Ni to green state EVEN made of rolls not disintegrated, The disintegration is only 50%

It may be possible that
Nucleus from an old
Cell might be entirely
regenerated in capacity by
subjecting them to this
vitalization by themselves

Important to try

S

Aug 15 1919

Am now going to run a Campaign to produce a Starting Storage Battery for Ford Cars to beat the lead,

Probably have to use Cobalt both poles —

To add to regular tubes & iron plates in the cell a group of plates with thin coating of Cobalt Oxide each pole & Close together These plates have small capacity but gives an enormous discharge Current for starting & nearly Exhausted after starting a few times are too Lead to keep lights going the Regular plates

will be drawn on ~~to~~

The CuO put together with 8% dehydrated H_2SO_4 — from Silver Lake makes strong acid — don't guess much blue

Soaked in water several hours then in NaOH 20% hardly any blue comes out was on hot plate on butter dish — they came out later —

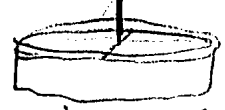
Note Must determine on both sulphur & iron plates which is best to first soak in water or NaOH, 20%

Aug 16 1919

Took an 8% sulphur 2" disc CuO, 20 drops 1 ft 3 drops 3' Soaked several hours in water removed water once, then put in NaOH 20% Tube still strong — Emptied out NaOH 20% & put in fresh — all on hot plate on butter dish —

Aug 16 1919

Expmts on plating Ni from Conc $NiSO_4$ — with the rotating Cathode



3¼ dia 1" wide Varnished all over except 1" face coated 8/4 — plain $NiSO_4$ peels at 1 amp density in 30 min —

with a little of Dewoddis dope, peels at 40 minutes at Edges, with several times more dope, 25 cc of a 10% sol Dont peel at all at 40 min its now running again after removing & washing

Outer surface very shiny no matter

With the 25 cc of dope it starts
Cracking at 60 minutes ~ —
1 hour at 1 amp gives thickness
8/10th mch — its more brittle than
without dope. Don't think
Can use any more on account
of this brittleness, will add
25 cc more monday & try it
& then go on other schemes —
should go 1 hour at 1 amp
OK —

Put 50 cc more Dimroddice
dope in making about
75 cc — previously filtered
the solution,

On. 243 1/2 amp for 5 min then 1 amp

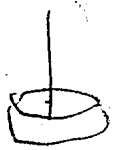
Look at it 3,37 pm — Runs 120 Res min
2 min off. well broke. off 3 35 not
Cracked but edges look a little
that way put it back lost 1 min
3.37 OK put back till 4 stopped.

Aug 18 1918

Ni Strips 1/16 holes 2 strips on 20%
NaOH Holes filled with
Colart reduced by H,
Charged + discharged,
only small momentum
Current on short circ
then amular.
Charged 1/2 amp —

Evidently necessary
with the reduced in
holes — or make the Co
by H Extremely fine,

Later Hydrate all comes
out on. 6 M.amp
will try Co by H again as I
had too high density well was
6 M amp —



with 100 cc of strong Dimondale dope

Can plate 1 hour at 1 amp before cracking this is at rate of 8 amp per disc

This is about limit for this combination,

Very polished - not so very brittle but crazy & sharp bend

Calliper 1.4/1000 - seems had many cracks - probably 1/1000 limit at this density,

Aug 19 - 1919

On 1 amp - $NiSO_4$ 100 cc strong dope -

120 deg Fahr -

1217 pm Calliper 1.25 -

Density is about 100 Milamp per inch -

Off 217 - quite thick only peeled off Edges some places in 1/8 but really OK -

Summed all bubbled up wont stand 120° Fahr -

This Ni is very difficult to peel off its very brittle & ng

There is nothing much in Dope it helps a little - Hot also helps

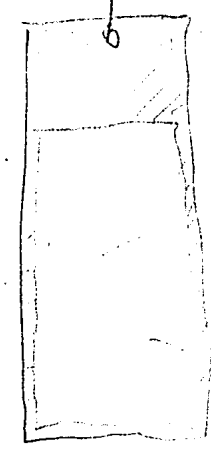
next page

Zone, should say that
heat. 120 + 100 cc dope
Coned 50 amp square inch
for 5 or 6 hours 2 or 3 times
Better than Normal Temp 16 deg
But heat is objectionable
as is strong dope —
Well now try Cone
NiCl at normal Temp —

Nearly Sat NiCl — 17% metal to
100 cc liquid —
On 440 & 540 — nothing
but Cu plated on & thin at
that — 1/2/1000

Aug 20 1919

Experiments to increase density of Cuprous & prevent peeling of Nickel



2" Copper

Surface approx 2"

Cone H_2SO_4 [illegible] temp

Started peel at edges in 30 min - 200 ma/amp

No 2 nearly saturated Sol of Nickel Chl found it all peeled bad in 40 min at 200 mil amp – deposit Copperish as if some impurity in it –

Made it 1/2 strength by water on 6 pm – Called away went 1 hour 20 min found it peeled to bright deposit now

Will repeat

Started another in the 1/2 strength NiCl Sol.

8.27. – 858 30 mins peeled, + brownish must be some impurity This is not so good as sulfate –

By nickel plating process a solution, This nickel made anode in Hypochlorite of soda (old) Covered with black Nickel hydrate + rough surface is pretty adherent. Think this can be made ok if formed + then washed + dried –

Think you could not detach it VERY PROMISING

See 19 sheets back

With nearly all hypochlorite (old) & very little salt builds up on plated Nickel in strongly adherent black oxide at 1/2 amp density it starts in dots which gradually increase in size until in center electrode almost covered with them —
Wants strong fresh hypo & perhaps salt more or less as time,
Very promising for "food starter,
I found if put in NaOH 20%

and 1½ amperes used it being thought that it don't detach any it very adherent so hard get off with finger nail & OK

I now reverse & make it Cathode using 1½ amp to get recovered gassing to see how much detached 90% still on the nickel plated on the Copper too thin, went thru to Copper

tomorrow plate Copper thick
& then form it in strong
hypo & pass it as anode &
Cathode

The total capacity against
Iron pockets in 18% KaOH
2 Li OH, -

11 25 pm 20th Aug 1919
good Night

Fresh hypochlorite Soda strength
for peroxidizing 25 grms iron
per Litre of Hypo

This on plated Nickel forms
the black dots of Nickel hydrat
rather freely, & Coul G. made it
work dots flatten & increase
in size and most adhere even
with gas coming off

Either as Cathode or anode

Will try salt & other Chemicals
in it. Its probable also
that if coarsher & thicker it
will stick to iron adherent.

I am trying to get it covered
all over & not with dots —

Iodine in Alcohol Matters the
Ni but dots do not form any
quicker,

Chlorate Na + free NaOH, dont
work.

Fluoride soda NaOH
no good,

First dark all over Even
blackening on Coral metal
Strong Sol of Nitrate Soda
& fresh Hypochlorite Soda
Make all kinds Experiments on
this — $NaNO_3$ very impure
get pure — Later Even with pure
$NaNO_3$ do not Gather

The spots I guess are holes in the nickel plating giving access to the copper & the copper hydrox that comes ~~off~~ thru holes & is so tenacious
Use solid Ni & see if get it —

Glucose 50 grms (dry anhydrous)
50 grammes of old mix from tubes mostly pencils on hot 4 drops oil butter dish 4 few hours direct on hot plate.

200 cc water

10 grms 20% NaOH
is 90% etalurgically operated then 10 needed in later —
The balance 10% in 5% H_2SO_4 ord temp after 2 drops & a little agitation is also all operated
This makes a very satisfactory ~~[illegible]~~ process practically hardly any flake broken up more by this process
probably 24 hours at 212
Will be sufficient & probably less glucose will be necessary

I find the one that has only 25 grms only glucose is just as good, probably Even less glucose will do

Spots come also on solid nickel

Got 100 ma from the spotted Ni probably 1/2 sq. in would be area of black. Used Zinc to discharge it. No gas then suddenly gas after 10 min at 100 ma — Will hg up a discharger measuring Volts + amperes Transferring Electrodes from Corroded after washing to the cell for charging after washing not corrodes liquor, then Charge fully + transfer to Zinc discharger

The dotted Elec Cu Ni plated after formation, washed Charged 30 min 50 mil deep at discharge without gassing + kept Voltage up 15 min 50 amp suddenly gassed — I fear Copper interforming will deep with all Ni Electrodes —

Note.

~~Perhaps P + N Zinc plates amalgamate heavily one anode oxidized~~

Possibly Zinc + Nickel N Coated with heavy Coat Hg Oxide by anodizing put with Zinc — See what Voltage is — also provide means by pockets to lead Hg when reduced to metal or amalgamated Nickel

I notice Nickel as anode in NaOH 20% Saturated with HgO gives fine yellow coat of HgO — 1/2 amp max Coat

Aug 22 1919

Experiments on plating Nickel on 2 sqr inches of filmed 6/4 — also forming $Ni(NH_3)_2$ in solution

All solutions are nearly saturated $NiSO_4$.

To each solution is added 6 grms of a chemical

#9 — 6 grms Ferrous sulphate
1 hour 200 ma, all curled + dark

#10 6 grms Boric acid
one corner turned up + bottom inch darkened at 1 hour 200 ma — sheet is fairly tough tends sharp right edge
OK at Edge

#7 — 6 grms Cobalt sulfate
all peeled bad.

NOTE Aug 22 1919

So far Sodium Amalgam on nickel + forming in Hypochlorite most promising for coating surface Entirely with adherent Coating of black hyperoxide not rubbed off by finger –

Took anodes formed after soaking in water several hours + charged it 100 ma rate for in 20% having some Light

Then discharged it at 50 ma rate in 20% Containing a Little Light. using Zinc Neg pole –

Ford on anode

#8 peeled along the edges, all Edges but film as whole not peeled film thick, not quite so tough as #10.

So far #10. most promising Aug 22 1919

6 – Manganic sulphate 6 grams anode get black – fine plating best yet only two top edges turned up a little, all rest sharp + perfect Edges – This is more promising than # 10 – The peroxide of Mn is very adherent on the Nickel + may work on Ford starter as P Element

5 NG – all yellow scarcely any deposit, gases too NG – The anode is bright + corroded Very Considerably Dark yellow as Sodium Chromate

Note –

Possibly Manganese Peroxide coated on nickel could form with Zinc in 20% NaOH, a ford starter battery if on reduction the hydrox dont dissolve in the alkali

I put the MnO_2 in 20% a considerable flake off – this could be stopped by porous nickel on plate.

Ford – the Hg Amalgam Electrode, Charged 53 min at 100 ma amp gave on discharge with Zinc 40 min at 50 ma amp – then when I tried to keep 50 ma rate up by lowering resistance it gassed + some few black flakes were detached 5300 ma minutes – gives 2000 ma minutes rather low efficiency 40% but this can be improved!

Now recharging at 100 ma only went 2500 ma minutes before gassing

Now discharging 50 ma

#1 250 NaSoy Sat — 6 grms Sulphate Alumni — OK at 1 hour but could see tendency at top corners to peel — put in 20 minutes more peeled easily up — Solution Cloudy

Promising — try strength to acid —
bright + good donut slow might dimple (?)

It Calipered 1.8/1000 but squeezing down req Caliper to flatten out round wires went to 1/1000 which is very good for 1 hour according to this only requires 4 hours for 1/1000 the thickness required on dials. As these slips are very sensitive to peeling I think a dose would not peel at this density before 2 possibly 3 hours — if Dennidie dope not in 4 @ 5 hours — which would be sufficient

Ford – Amalgamated Ni by Na Amalgam then 100 Ma for 2 hours oxidizing. Dipped it against Zinc only lasted 2 min 50 MA

So far only Ni hydrox any good, 50% Efficiency But it may be better as Zn Voltage is higher, (1e) 170 Chg + 185 dipping with Zinc –

Ford, German Silver not attacked in Hypochlorite So but if a little NaCl put in its attacked in spots one spot 3/8 by 3/4 long attacked + deposited green coloured ones blackened by the Hypo-ClO dont seem strong enough material to attacked by using Cl from NaCl it attacks on rubbing the black off the spots form quite strong corrosion – Washed it off + put back instantly whole area of this big spot filled with green density 1.1/4 amp

#4=250 NiSO4.
6 grms Chromic sulphate.
blackens surface + does not deposit any nickel –

250 cc of
Silicofluoride Ni ~~[illegible]~~
no deposit of nickel black –
its very acid must get this right as other man did so –

Know neutralizing the Ni of Silf Ni by Ammonia + filter Enormous deposit of precipitated Si + Ni –
will try it again –

Later found German Silver has layer of Copper rolled on it — fake G.S. —

Tried, Thick pulp $NiSO_4$ pp by NaOH, both Electrodes showed on pulp + 1/2 amp put on in 20 mins Anode Entirely Cooked black both sides + does not wash off —

I am now discharging it 50 ma —

Plating —

Silico Fluoride Ni after nearly neutralizing pickled but peeled Easily — Not very brittle,

18 — $NiSO_4$ + 6 grms Sulphate Lithia, peeled around edge all way round, Nickel not tough won't bend much

Flake — The

10 cc 20% NaOH
25 grms dehydrated glucose
50 " from old Nickel tubes
200 cc Water
on boiler deck exposure

OK 98% thru 10 mesh — balance deposited by 2% H_2SO_4 —

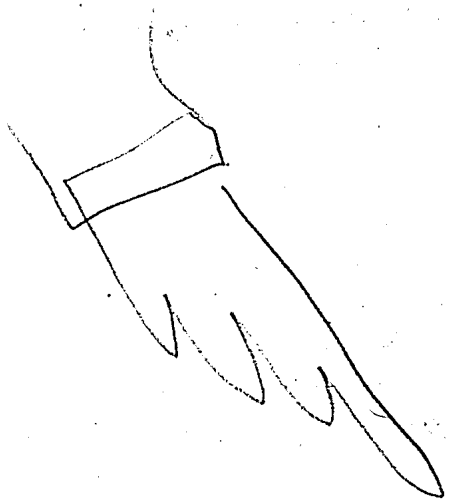
OK —

Oct 15 = 250 cc $NiSO_4$ + 6 grms Ammonia Chloride Ni peeled off - film perfect not cracked at Edges found it in bottom of Cell. Rolled up but perfect and cathode had a fresh nickel film on also perfect brilliance deposit as usual This is a PHENOMENON

Vary it.

Oct 22 250 cc $NiSO_4$ 6 grms Ammonia sulfate (12) solution All covered with black after peeling off found nickel film on but too thin to peel with knife NG

Oct 27 = 250 cc $NiSO_4$ 6 grms Hg Cy film lead color granular hardly any thickness May act as Ford gas off gas in plating



NOTE →

Oct 16 250cc $NiSO_4$ 6 grams Ammonium sulfate, peeled peculiarly 45 minutes, brittle

Oct 19 – 250cc $NiSO_4$ 6 grams Magnesium sulfate, peeled at edges 1" + corners turned up thick 45 min – rather tough ni –

Oct 13, 250cc $NiSO_4$ 12 grams Dibiscafluoride Not peeled, black streaks, Ni tougher than any yet

Something peculiar about this – PHENOMENON + Nancy

Collapses $1\frac{1}{2}$/1000 seconds 3 or 4 times longer than usual film

Ott #14 41 grms Potassium [illegible]
=[illegible] out most of the Ni but
slowly successfully any deposit
NG -
gases [illegible] -

Ott 12 - 250 cc $NiSO_4$
24 cc H_2O_2
All cooled looks like a film -
[illegible] coat yet.
gases carefully

Ott #21 250 cc $NiSO_4$ 6 grms
Ammonium [illegible] Nearly
Micro Cracks, Very thin film on NG
gases

20 – 250 cc $NiSO_4$ 6 grams
Glacial phosphoric acid.
Pickled up in 1 oz. poly 50 minutes
Tarnishing not as usual

Off 32 – Water + 75 grams $Ni(NO_3)$
neutral with $Ni(OH)_2$ = gases
Coated perfectly with what is
probably $Ni(OH)_2$ or a basic
salt. Sibelled up to $\frac{1}{32}$ thick
perhaps more not injured in
any way — Electrode put
in water clings a-gases
perfect deposit

PHENOMENON

May be field of Copper

Anode has what appears to be copper on parts

May be OK for Ford
after soaking 10 min put in forming bath
25 milamp ½ broke off other ½ in contact
DONT SWELL in NaOH!!

---

32 The [illegible]
is actually [illegible]
[illegible] $Ni(OH)_2$
dont swell in NaOH [illegible] Wonderful

Ott. 23 250cc NiSO4. + Calcium sulphate in excess - peeled probably 40 @ 45 min, little tougher than most, not prominent
No gas

Ott - 51 250cc NiSO4.
6 grams of Cyanam -
all peeled probably 30 minutes
No gas - [illegible]
as usual -

Ott 52 250cc NiSO4
3 grams Pyridin
Black - no nickel deposited
Anode bright.

54 OCL 250cc NiSO4
6 grams Potash alum
No all fine cracks Anode bright
+ dark - glycerin
should be neutral

(175)

Ford –

Great, $Ni(OH)_2$ deposits on Cathode in tenacious film which covers over all very perfect + Even. It charges with 25 ma on one inch of cathode in Sol. without gas seen It discharges for several minutes at 180 ma with Zinc + drops molarity to Zero of Zn Ni. metal,

Using 32. Nitrate Nickel made neutral by $Ni(OH)_2$ 250cc having 75 grms $Ni(NO_3)$ = its rather impure having considerable Copper

PHENOMENON

Ford Starter

Very adhesive electrodes should have holes to clinch it

Ott 46 250cc $NiSO_4$ 6 grms Ammonium Sulfate No nickel deposited — black film Anode about bright!

Ott. 72 – 250cc $NiSO_4$ 2 grms Ag. Sulfate, no deposit Ag was deposited but all came off as a sponge very finely divided May have a film oxide Ag on Anode –

Ott 64 250cc $NiSO_4$ 3 grms Mercuric Sulfate Spit off Early – bottle amalgamated Ng – Anode clean

PHENOMENON

If this adheres at light
It will be useful in to
make it stick to other
metals,

Does Chloral H affect Selenium
INVESTIGATE

Fine result Ni Fine Tough

Oct 55 250cc Ni SO4 1 hour
6 grms Chrome alum
1 hour no peel, put it back,
for 20 minutes, found it peeled
nearly off. Its Tough if bent
in 1/8 radius at right angles Cracks
a bit. PROMISING !

Very proportional.

Calipers hard pressed 1.3/1000

~~Nb Oct – 250cc Ni SO4~~
~~6 grms Chrome alum~~

~~Same 1 hour no peel 20 min~~
~~or 10 min 1 inch still~~
~~not peeled found it back for~~
~~more minutes but knocked to~~
~~pieces~~

after 2 hours no peel but I find
that the film sticks perfectly as if it
was integral thats the reason it
dont peel Horribly tired failed to
use 8/4 Try it again
Dup Ng was alive

Ford - Depositing $Ni(OH)_2$ on nickel if it has holes say 40/1000, + deposit on both sides Ni cathode being matte will give all that is wanted. On polished Ag Silver it deposits but tends to flake off when 200 ma for 1/2 hour at 200 ma rate if it had been matte + holes could probably gone to one hour per inch surface exposed or 2" with back - 100 ma per inch 1 hour is $\frac{1}{10}$ ampere per inch or 14 amp per sqr foot.

Aug 25 1919 -

We are now rigged up so we can plate Ni in 6 cells at once each a different solution, Have plated 30 already

53 3 gms formaldehyde alone

Cracked all over NG

61 = Cracked one edge one corner buffed NG Ni ok Ethyl Alcohol 6

62 Cracked all around Edges NG Methyl Alcohol 6

not springy

78 = 250 Ni SO4 6 Tartrate Soda
one edge lifted Very white
matte good nickel —
Very — When pulled off Curls
a little This comes bent at sharp right angles

Can crumple up
absolutely no spring to it

77 250 Ni SO4 6 Citrate Soda
Very white matte, fine ni —
one edge lifted away a very little
Strips perfect, Nickel sheet about
Curl — PROMISING Very ! ! S S
Very tough can bend sharp at
right angles without cracking.
This is longest Ni yet + so
Altogether the phenomenal result
Caliper 0.8 —

63 - Badly cracked all around
2 dg2 N.G. Recently Bad
6 acetone

= Promotheoics Herman Salt
~~Bent~~ Curled up at 4 Edges
also both sides + bottom —
after stripping it lays nearly
flat
Not so good as Citrate,
Collyers 1000'

---

88 — 250 $NiSO_4$ — Only Glucose 6
It has very little plated on
one place ~~bare~~ — find it had
stripped Early + fallen off
Very brittle NG

83 : 250 $NiSO_4$ 6 Na Carbonate
all stripped NG
Anode Red deposit.

73. 250 $NiSO_4$ — 3 gms Ag Nitrate
all slow came off has sponge
NG

60 250 Ni SO4 3 Hydrazine Sulfate
Cracked, hardly any NG —

76 - 250 Ni SO4 Dup 6 grms Chloral Hydrate
poor plating. Very thick + some come off - balance Cant be removed probably because deposit too thin NG.

96 - 3 grms Bromoform -
stripped off completely, cracked all around Edges At a 2nd Coat started all over NG

92 6 grms Sodium Pyrophosphate
Nothing

90 = 6 Sodium Pyrophosphate
Cracked NG -

Following large quantities of following Nickel Baths are to be made to Dup the NiSO4 salts

About 50 Liters of Each salt

Acetate
Trichloroacetate
Bromate
Bromide
Chloride
Fluosilicate
Fluoborate
Formate
Chlorate
Perchlorate

At first on 500 cc is to be made for test cells. ——
The solution should be pure + neutral as possible
No iron or Copper in it,

79 — 6 Ammonium Citrate
Chrome as a cathode + part of 2nd Coat stronly Brittle + Not promising —

101 — 6 Chromic Alum
Black Scaly any deposit NG

82 — 6 gram Carbolic acid
all Cracked NG —

124 6 Manganese Acetate
Bad Cracks Anode get black

125 — Mud of NiOH dark deposit
no metal Anode get black
6 grams Manganese Nitrate

100 — 6 Epichlorohydrin — all
Cracked NG —

Note As Ferrous Nitrate deposits on black hydrox on Cathode
We could make active iron by Electrolysis for Storage Battery in place of the present expensive process - S S S

Ford

118 Magnesium Acetate 6 gr
Perfect - not burned up or Cracked - Tough. bends right angles film flat, Matte White surface fine - Dup & Vary
Calliper 1.1 /cm
Liquid flocky Sediment at bottom

122 6 grms Magnesium Nitrate
Sol Clear no metal dark
VERY Adherent $Ni(OH)_2$ but dark, even hard to scrape off with Knife + quite thick -
Anode clean -

121 6 grm Magnesium Chloride
anode clean Sol Clear
all Cracked -

147 - 6 grm Cadmium Acetate
anode clean Sol slight flocks, loose
Not of Cadmium a thin film
Cd on Cathode NG

from 132 boy made mistake + got too much 6/4 fred dil clean oozy but poly bad

~~117~~
~~132~~
~~127~~
142
133
~~116~~

Should be deleted

for

132 6 gms Manganese Sulphate
Anode got black deposit, cracked
Edge turned up, film hard get
off - brittle NG

127 6 Manganese Chloride
Anode clean, Dol clean
film cracked, brittle hard get
off - NG

142 - 6 gms Lithia formate
Dol clear Anode very clear
Not cracked strips hard
tho good clear Dep

133 - Lithium Acetate -
Dol clean Anode clean
Not cracked but Cant strip

140 6 Lithium Nitrate -
Thin Coat dark - No 0 1/2

End of Book 2

[ITEMS(S) FOUND IN BOOK]

1.40
60

100 Mil amp for 10 minutes
on 2" - if perforated it could
be 1 full inch -
6" inches would give 100 mil
amp for 1 hour.
60 inches 1 ampere hour

Wanted 150 amp for
or 50 discharges of 150 p
adapters each requiring
15 seconds - or 150 amp
for 12 minutes -
or 30 amp hours capacity
1800 inches will give the
capacity, discharge rate would
be 300 Ma -
50 plates 6 X 6 -

[ITEMS(S) FOUND IN BOOK]

If get 20 minutes, only
50 plates necessary